Children and the Environment: A Developmental Pediatric Perspective

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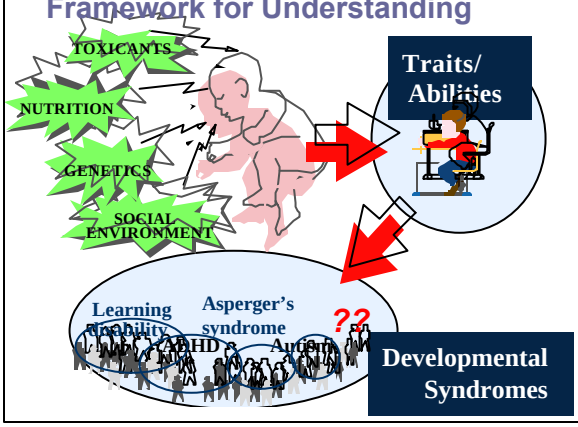
Developmental Theory

- Nature
  - Genetics
  - Temperament
- Nurture
  - Environment
- Transactional theory

Environmental Factors

- Chemicals and toxins
- Physical surroundings
- Home
- Education
- Social cohesion e.g., violence
- TV, video games, mass media
- Political environment

Framework for Understanding



Reported Trends: Real? Better reporting? Changing criteria?

Learning disabilities

- **191%** ⬆ *Children in special education: 1977-1994*

ADHD

- **1 ➡ 20%** *Reported prevalence*
- **>800%** ⬆ *Ritalin use since 1971*

ADHD

- **Between 4 - 12 % of all school-age children**
- **The most common childhood neurobehavioral disorder**

Learning Disabilities

- Impairment in abilities underlying academic function
- Neuromotor incoordination
- Difficulties in orientation
- Impaired social adaptive functioning
- Behavioral manifestations

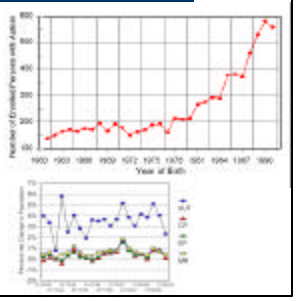
Autism Spectrum Disorders

- 'Classic' Autism
- PDD NOS
- Asperger's Syndrome
- Rett's Syndrome
- "Others"

Trends, Prevalence, and Clusters

Autism

- **100% *Autism over 30 years***
- **210% *Autism in California DSS System: 1987-1998***
- **400% Above nation: *Prevalence in Brick Township, NJ***

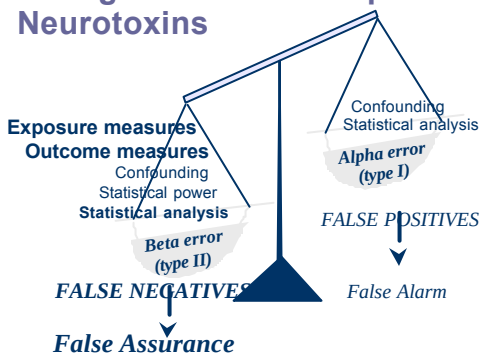


Etiology of Autism

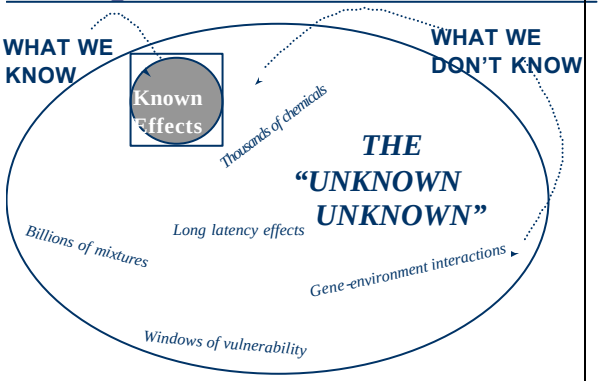
- Several genes interacting with many environmental factors
- Autism as a birth defect

Patricia Rodier, PhD
University of Rochester
Joseph Warkany Award
May 23, 2003

Recognition of Developmental Neurotoxins

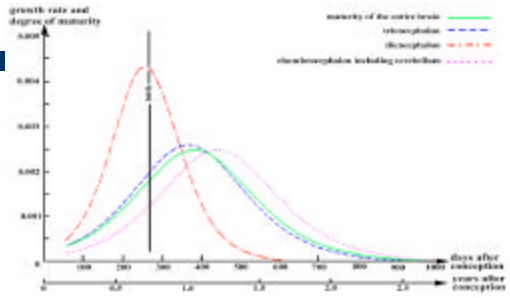


Recognition of Toxic Threats:



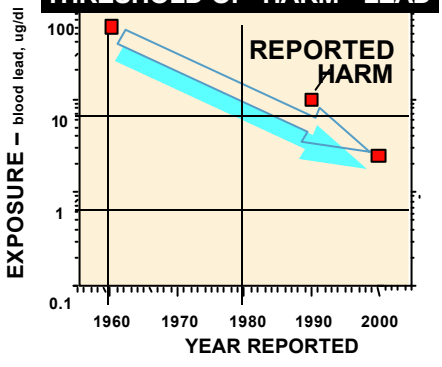
LEARNING, BEHAVIOR, AND DEVELOPMENT:
A SPECTRUM OF ACADEMIC DISCIPLINES

Human Brain Growth Rate



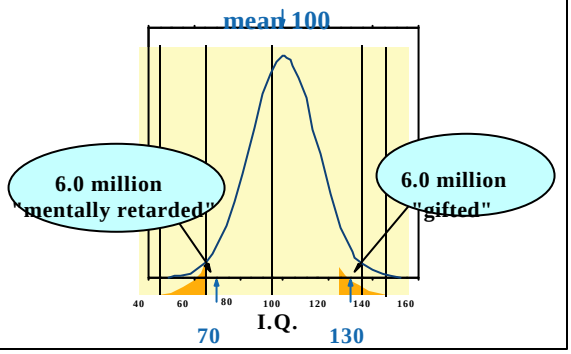
Herschkowitz *et al.*, 1997; *Neuropediatrics*, 28:296-306.

DECLINING THRESHOLD OF HARM - LEAD

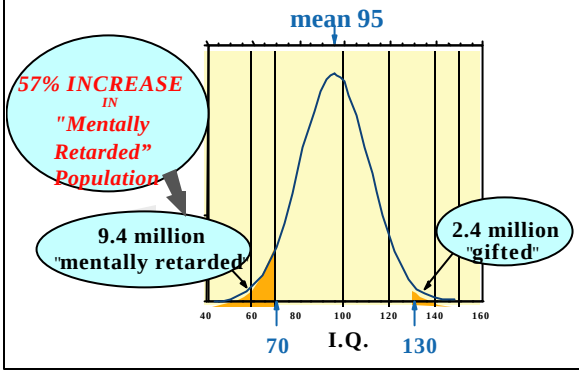


Note: Exposures expressed in micrograms/deciliter (blood lead)

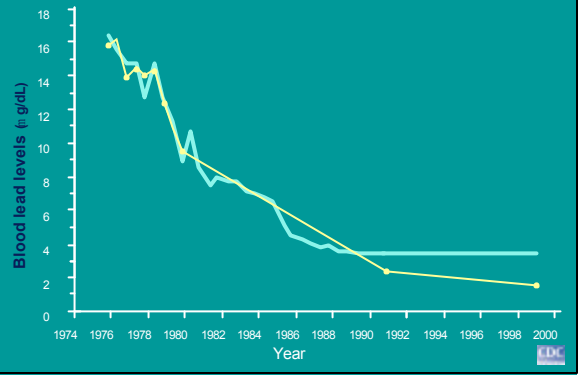
A SMALL SHIFT IN IQ DISTRIBUTION IN A POPULATION OF 260 MILLION



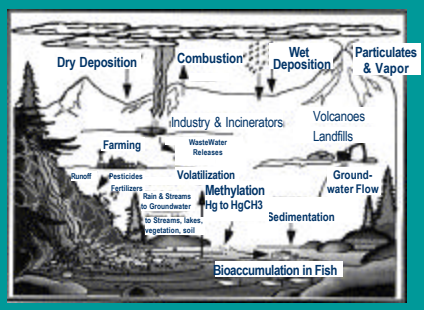
5 Point Decrease in Mean IQ



Blood lead levels in the U.S.



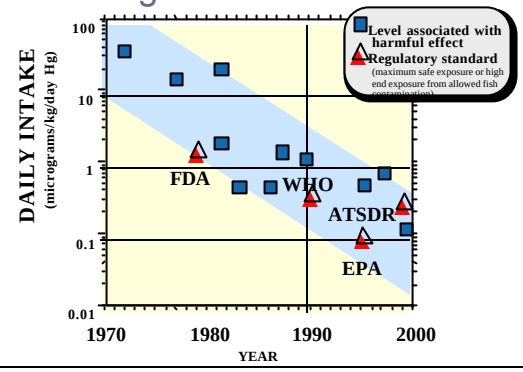
An Overview of Mercury



Mercury: Effects of higher dose prenatal exposure

- Mental retardation
- Seizures
- Cerebral palsy
- Disturbances of vision, hearing, sensation
- Abnormal gait
- Abnormal speech
- Disturbances of swallowing and sucking
- Abnormal reflexes

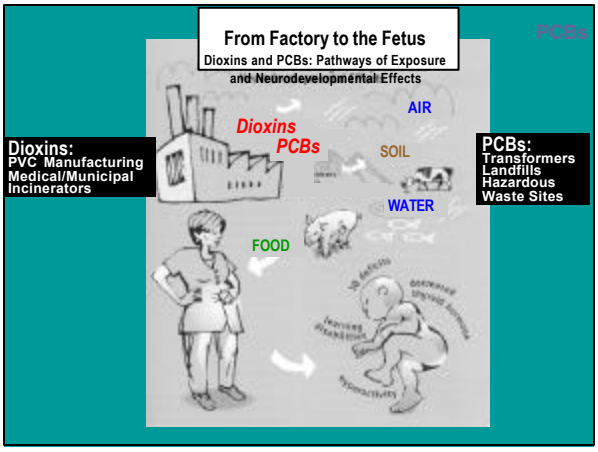
Mercury: Declining Threshold of Harm



Mercury Exposures

Advised Exposure Limit

- **EPA Reference Dose ("safe" upper limit) – 0.1 microgram/kilogram/day**
- **Equivalent consumption limit**
  - Women: 1.5 oz. swordfish or 7 oz. tuna/week
  - Children: 1 oz. tuna per 20 lb. body weight/week



Pesticides

- Physical, chemical or biological agent intended to kill an undesirable plant/animal pest
- Major classes: insecticides, fungicides, herbicides
- Most pesticides are synthetic agents new to humans and the environment
- Inherent toxicity

* 1999 estimates

Pesticides

- Reported use: 98% of families, 80% during pregnancy
- In Humans - detectable chlorpyrifos metabolites in 92% of children's, 82% of adults' urine samples
- In Food - detectable residues of at least one pesticide on 72% fruits/vegetables
- In Homes – 3 to 9 pesticide residues in typical home with 70% infant exposure from dust
- In Air - indoor air levels 10-100X higher than outdoor air
- In Water - >90% stream samples, 50% of wells

What about the children?

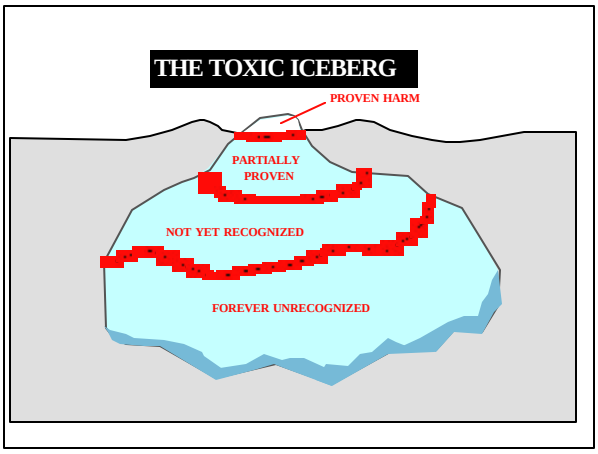
- Deficiencies in animal studies:
  - Underestimate human DNT by 100-10,000x
  - Single genetic strains
  - Test single chemical exposures (cf. mixtures)
- Prospective epidemiological studies rare
- Adult norms

Emerging Themes

- With understanding of neurodevelopmental effects, estimates of toxic thresholds fall
- Animal testing underpredicts human vulnerability
- Subtle effects in individuals carry profound impacts when expressed over a population
- Adverse effects of some DNT are synergistic or additive

Summary: Policy Principles

- Disabilities are widespread
- Chemical exposures are preventable
- Toxicity at high doses should be a red flag for harm from low-dose "background" exposures
- Slow rate at which "proof" of harm materializes, results in at risk generations being harmed before adequate regulatory response occurs
- Protecting children will require a more flexible regulatory system capable of preventing as well as responding to widespread exposures and harm



Acknowledgement

In Harm's Way
&
Leslie Rubin, MD